

Checklist of Orchid bees (Hymenoptera: Apidae) of “Lago do Silêncio” Area, Boca do Acre, Amazonas, Brazil

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ABSTRACT: This study presents a list of euglossine-bee species collected in the Lago do Silêncio region, municipality of Boca do Acre, in the Brazilian state of Amazonas, southwestern Amazonia. Euglossine males were attracted to odoriferous baits on December 3 and 4, 2004. A total of 234 individuals belonging to four genera and 25 species were collected. Despite the small sampling effort, the local euglossine fauna is abundant and rich, when compared to those of other areas in the Brazilian Amazonia where higher sampling efforts were performed. Therefore, further studies in the region can be important for improving our knowledge of the bees in the Amazon region.

INTRODUCTION

The Amazonian region is considered to be the most diverse of the planet and innumerable studies have been undertaken in the region (WWF 2010). However, many areas in the region have not been inventoried and are considered knowledge gaps as far as biological diversity is concerned.

The orchid bees belong to the subtribe Euglossina, comprising five genera and about 200 species distributed in the Neotropical region, with some species occurring beyond the tropics (Dressler 1982; Roubik and Hanson 2004). Their diversity is highest in humid forests, with few species occurring in savannas and gallery forests (Dressler 1982). In Brazil, according to Nemésio and Silveira (2007), the Amazonian region is the richest in euglossine species. In general, the greatest richness of euglossine bees has been found in preserved forests, however, some species such as *Eulaema nigrita* Lepeletier, 1841 are found in open or disturbed areas (Morato *et al.* 1992; Peruquetti *et al.* 1999; Nemésio and Silveira 2007). Thus, the group is considered a good indicator of the conservation status of pristine environments (Morato 1994).

Although several studies have been carried out on the Amazonian orchid bees in recent decades (Braga 1976; Powell and Powell 1987; Becker *et al.* 1991; Morato *et al.* 1992; Morato 1994; Oliveira and Campos 1995, 1996; Otero and Sandino 2003; Nemésio and Morato 2004, 2005, 2006; Rasmussen 2009; Storck-Tonon *et al.* 2009; Oliveira *et al.* 2010), Roubik and Hanson (2004) estimated that only 1/3 of the existing euglossine species in the region have been described.

The “Lago do Silêncio” (Silence Lake) area, in southwestern Amazonia, represents one knowledge gap for the euglossine bees, since there is no record of euglossine sampling. Thus, sampling this region is important for extending the knowledge on the biogeography and on the composition of the local euglossine bee faunas in Amazonia.

MATERIALS AND METHODS

Study area

The region known as “Lago do Silêncio” is characterized as an abandoned meander lake, located in southwestern Amazonia, in the municipality of Boca do Acre, Amazonas state, Brazil (08°50’56” S, 68°42’26” W), on the left margin of the Purus River. The regional climate is classified as hot and humid with high humidity throughout the year and monthly averages ranging between 80 and 90%; maximum temperature may exceed 33°C and average rainfall is 2,532.4 mm (Acre 2006). The periods of flood and drought vary according to the rainfall in the headwaters of the Purus River. The surroundings of the Lagoa do Silêncio are covered by rainforest remnants.

Data collection

Bees were collected in December 3 and 4, 2004, between 7:00 and 14:00 h. According to Oliveira and Campos (1999) the time of highest activity of Euglossine is between 9:00 and 16:00 h, however, as of 13:00 h the number of individuals captured tends to lessen considerably. Male euglossines were attracted to chemical baits made with cotton swabs dipped into one of the following odoriferous substances: vanillin, cineol (eucalyptol), methyl salicylate, benzyl acetate, and methyl cinnamate. These substances are considered the most attractive to the regional euglossine bees (Oliveira and Campos 1996; Nemésio and Morato 2006; Storck-Tonon *et al.* 2009).

Eighteen collecting sites were located throughout the area covered by the lake. Nine sites were sampled on the first day and nine on the second day. At each site, a set of chemical baits were hung from a nylon string, approximately 1.5 m above the ground. Bees attracted to the baits were collected with insect nets. The collected specimens were identified and deposited in the invertebrate’s collection of the “INPA - Instituto Nacional de Pesquisas da Amazônia”.

RESULTS AND DISCUSSION

Two-hundred-thirty-four euglossine males belonging to four genera and 25 species were collected (Table 1), representing about 40% of the *ca* 63 euglossine species listed for the Amazon region (*e.g.* Braga 1976; Powell and Powell 1987; Becker *et al.* 1991; Morato *et al.* 1992; Morato 1994; Oliveira and Campos 1995; Nemésio and Morato 2004, 2005, 2006; Nemésio and Silveira, 2007; Storck-Tonon *et al.* 2009; Oliveira *et al.* 2010).

The genus *Euglossa* Latreille was the most abundant (159 specimens; 68% of all bees collected), followed by *Eulaema* Lepeletier with 49 specimens (20%), *Exaerete* Hoffmannsegg with 14 specimens (6%) and *Eufriesea* Cockerell with 12 specimens (5%). However, in other studies in the region, *Eulaema* is usually the most abundant. In the studies of Storck-Tonon *et al.* (2009) and of Nemésio and Morato (2006) more than 50% of the individuals belong to *Eulaema*.

The most abundant species was *Euglossa ignita* (Smith, 1854), which represented 30% of all bees collected. A similar result was found in the Amazonian region by Braga (1976) and Otero and Sandino (2003). However, this species was not abundant in the studies of Storck-Tonon *et al.* (2009) (5%) and Nemésio and Morato (2006) (7%). *Eulaema meriana* (Olivier, 1789) was the second most abundant species (17%). This species was more abundant in the work carried out in Acre state (*e.g.* Nemésio and Morato 2004; Storck, Tonon *et al.* 2009) but was abundant

in some studies in the Amazon (*e.g.* Oliveira and Campos 1995). The other species were less abundant, each accounting for less than 10% of the total abundance.

Only five individuals (2%) of *Eulaema cingulata* (Fabricius, 1804) were collected in this study. However, this species was the most abundant in the studies by Storck-Tonon *et al.* (2009) (24%) and Nemésio and Morato (2006) (27%).

Cineole was the substance that attracted more bee specimens and species (Table 1). This was also the most attractive bait in the work of Becker *et al.* (1991) and Morato (1994). Methyl salicylate was the second most attractive and this was the substance that attracted more species of Euglossina in others studies in the region (Powell and Powell 1987; Morato *et al.* 1992; Oliveira and Campos 1996; Storck-Tonon *et al.* 2009).

Although this is a well preserved area, one individual of *Eulaema nigrita* was collected. This is remarkable, since this species is not usually collected in pristine forests in the Amazonian region, and has been considered a bioindicator of disturbed areas (Morato *et al.* 1992; 1994; Peruquetti *et al.* 1999; Nemésio and Silveira 2007). It is also important to note that Storck-Tonon *et al.* (2009) collected a large amount of *E. nigrita* individuals in urban areas in the vicinity of the municipality of Rio Branco, Acre state. This species has been found to be more abundant in the southern, southeastern and western regions of

TABLE 1. Abundance and richness of orchid bees attracted by different odorous substances in the Lago do Silêncio region, AM, Brazil. MC = methyl cinnamate, BA = benzyl acetate, CI = cineol, MS = methyl salicylate, VA = vanillin and ND = not defined (species collected at the sampling site, before choosing any of the baits).

SPECIES	MC	BA	CI	MS	VA	ND	TOTAL
<i>Eufriesea surinamensis</i> (Linnaeus, 1758)		3		1	3		7
<i>Eufriesea superba</i> (Hoffmannsegg, 1817)				3	1		4
<i>Eufriesea pulchra</i> (Smith, 1854)			1				1
<i>Euglossa amazonica</i> Dressler, 1982		1	5				6
<i>Euglossa augaspis</i> Dressler, 1982			1				1
<i>Euglossa chlorina</i> Dressler, 1982	1		12				13
<i>Euglossa cognata</i> Moure, 1970				1			1
<i>Euglossa ignita</i> Smith, 1874	2	9	27	25	1	8	72
<i>Euglossa imperialis</i> Cockerell, 1922			1	4			5
<i>Euglossa modestior</i> Dressler, 1982			7				7
<i>Euglossa mourei</i> Dressler, 1982	2	1	9	1	10	1	24
<i>Euglossa mixta</i> Friese, 1899	1			4			5
<i>Euglossa orellana</i> Roubik, 2004	3		6	6	2	4	21
<i>Euglossa pleosticta</i> Dressler, 1982			2				2
<i>Euglossa variabilis</i> Friese, 1899				1			1
<i>Euglossa viridifrons</i> Dressler, 1982			1				1
<i>Eulaema bombiformis</i> (Packard, 1869)				1			1
<i>Eulaema cingulata</i> (Fabricius, 1804)	1	2			2		5
<i>Eulaema meriana</i> (Olivier, 1789)	6	12	4	12	1	5	40
<i>Eulaema mocsaryi</i> (Friese, 1899)			1				1
<i>Eulaema nigrita</i> Lepeletier, 1841						1	1
<i>Eulaema pseudocingulata</i> (Oliveira, 2006)					1		1
<i>Exaerete frontalis</i> (Guérin-Méneville, 1844)		1					1
<i>Exaerete lepeletieri</i> Oliveira e Nemésio, 2003		1	5	1	1		8
<i>Exaerete smaragdina</i> (Guérin-Méneville, 1844)			4	1			5
Species Richness	7	8	15	13	9	5	25
Abundance	16	30	86	61	22	19	234

Brazil, where the sampling sites are usually placed in more disturbed and smaller forest fragments (Rebêlo and Garófalo 1997; Neves and Viana 1997, 1999; Peruquetti *et al.* 1999; Bezerra and Martins 2001; Nemésio 2002; Sofia and Suzuki 2004; Souza *et al.* 2005).

Despite the fact that only two sampling days were performed, the study area showed high abundance and species richness of euglossine bees. According to Roubik and Hanson (2004), six consecutive days should be sufficient to sample the euglossine richness of a given area. This study, and the works carried out by Nemésio (2010, 2011a, 2011b), suggest that shorter sampling protocols may be useful for Euglossina as long as they are conducted in the period of greatest activity of these bees. However, this study had nine points sampled simultaneously. Thus, greater number of sampling points may be important in rapid surveys. According to Storck-Tonon *et al.* (2009), the greater the sampling effort, the sample disaggregation, and the environmental heterogeneity, the higher is the probability of sampling

higher euglossine richness.

Some species of *Eufriesea* are highly seasonal, being active for only one or two months in the year (Dressler 1982). In this study, because the collections occurred during the period of greatest activity of the genus in the region (Oliveira and Campos 1999), three species of *Eufriesea* were collected: *Eufriesea pulchra*, *Eufriesea superba*, *Eufriesea surinamensis*. Storck-Tonon *et al.* (2009) collected only five species of the genus during 10 collection months.

The results obtained in this study were compared with those of other studies in the Brazilian Amazon for the abundance and richness of bees. This study has a high diversity and low dominance compared with other studies conducted in the region (Table 2).

Therefore, further studies in the Lago do Silêncio area, with a larger sampling effort, distributed throughout the dry and rainy seasons may reveal the presence of additional species, better contributing to the knowledge of the orchid bees in the Amazonian region.

TABLE 2. Orchid-bee abundance and richness in different localities of Brazilian Amazonia. AM = Amazonas; AC = Acre.

REFERENCES	STATE	ABUNDANCE	RICHNESS	DIVERSITY
Braga 1976	AM	76	8	1,39
Powell and Powell 1987	AM	992	12	1,90
Becker <i>et al.</i> 1991	AM	290	16	1,36
Morato <i>et al.</i> 1992	AM	1.242	27	2,21
Morato 1994	AM	838	25	2,27
Oliveira and Campos 1995	AM	2.422	38	2,34
Nemésio and Morato 2004	AC	254	22	2,01
Storck-Tonon <i>et al.</i> 2009	AC	3.675	36	2,54
This study	AM	234	25	2,36

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